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PATENT SPECIFICATION

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(54) IMPROVEMENTS IN OR RELATING TO TUBE WORKING TOOLS

(71) We, IMPERIAL-EASTMAN CORPORATION, a Corporation organised and existing under the laws of the State of Delaware, United States of America of 6300 West Howard Street, Chicago, Illinois, United States of America do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to tube working tools and in particular to tube and flaring tools.

One conventional form of tube flaring tool includes a body having a yoke portion and depending legs. The distal end of the legs are inturned to support a tube holding clamp in alignment with a flaring cone carried on the end of a stem which is threaded through the yoke portion and which is rotatable by means of a handle secured to its opposite end. One example of such a tube flaring tool is shown in the George E. Franck United States Letters Patent 3,027,931, owned by the assignee hereof. The clamp means for holding the tube end may be provided in the form of a pair of clamp bars which are adjustably drawn together to clamp the tube end therebetween in suitable confronting segmentally cylindrical recesses. An example of such a clamp bar means is shown in the Robert D. McIntosh United States Letters Patent 2,242,831. Another clamp bar of this type is illustrated in United States Letters Patent 2,314,221 of Edgar E. Kellems.

Still another flaring tool utilizing such tube clamping means is shown in United States Letters Patent 3,421,354 of Richard v. Strybel et al, owned by the assignee hereof.

A somewhat differrent form of tube clamping means is illustrated in the George E. Franck United States Letters Patent 3,073,375, wherein a pair of blocks having peripheral recesses are selectively positioned to hold different diameter tools in the flaring tool. In the flaring tool of the George E. Franck United States Letters Patent 2,774,408, the tube is clamped in a pair of blocks which are cubical in shape and which have the different surfaces thereof provided with the plurality of hemicylindrical grooves for accommodating different diameter tubes.

In United States Letters Patent 2,526,110 of Robert B. Edelmann, the clamping blocks are rotatably mounted to a body portion of the clamp structure.

In the tube flaring machine of Albert E. Watts disclosed in United States Letters Patent 2,532,250, two-part expanding dies are retained in support blocks carried in U-shaped brackets. A tightening screw clamps the blocks together to urge the expanding dies tightly about the tube to be flared.

In United States Letters Patent 2,124,743 of John G. McMahon, a tube flaring tool is provided utilizing a plurality of different size split die members, each having the same outside diameter so as to be selectively received in an opening of the yoke of the tool for clamped association with the tube end by means of a wing bolt.

In United States Letters Patent 3,044,531 of Frank R. Wilson, inserts are provided in the elongated clamping bars for accommodating the clamping means to tubing of different sizes.

In accordance with the present invention there is provided a tool for flaring a tube end, comprising: a body member having a yoke portion, and a plurality of spaced resilient clamping portions extending from the yoke portion in an annular array to define a generally cylindrical socket; a pair of part cylindrical jaws located in the socket and having opposed concave surfaces for engaging a tube to be flared; clamping means for urging the clamping portions radially inwardly thereby to urge the jaws inwardly to clamp a tube disposed therebetween; cooperable shoulder means

on the clamping portions and jaws for retaining the jaws against axial movement relative to the clamping portions when urged inwardly against a tube; and flaring means movably carried by the yoke and operable to flare the end of a tube held in the jaws, the resilient clamping portions being so arranged and constructed that the cooperable shoulder means on the jaws and the clamping portions are disengagable when the clamping means is released to permit insertion and removal of the jaws from the socket.

The body member may be formed of a relatively low cost material, such as moulded synthetic resin with the clamping leg portions defining relatively thin wall portions of the body member. The adjustable clamping means, in the preferred embodiment, comprises a band encircling the annular array of clamping leg portions to radially constrict the array and thereby urge the jaws into the desired tube holding position.

Other features of the preferred embodiment of the invention will be apparent from the following description given by way of example with reference to the accompanying drawing, in which:—

FIGURE 1 is a side elevation of a flaring tool embodying the invention;

FIGURE 2 is a transverse section taken substantially along the line 2—2 of FIGURE 1;

FIGURE 3 is a transverse section taken substantially along the line 3—3 of FIGURE 1;

FIGURE 4 is a fragmentary enlarged diametric section taken substantially along the line 4—4 of FIGURE 2;

FIGURE 5 is a longitudinal section taken substantially along the line 5—5 fo FIGURE 4;

FIGURE 6 is a transverse section taken substantially along the line 6—6 of FIGURE 4; and

FIGURE 7 is a fragmentary diametric section illustrating the mounting of the jaws in the clamping portion of the body member.

In the exemplary embodiment of the invention as disclosed in the drawing, a flaring tool generally designated 10 is shown to comprise a body member 11 defining a yoke portion 12 and an annular clamping portion 13. Thus, as seen in FIGURES 1 and 3, the body member effectively comprises a cup-shaped member with the clamping portion 13 being provided with longitudinal slots 14 spaced circumferentially about the axis 15 thereof. Resultingly, the clamping portion effectively comprises a plurality of segmentally cylindrical legs 16 depending from the yoke portion 12.

The body member may be formed of a suitable resilient material, such as molded synthetic resin, whereby the clamping portion 13 may be selectively constricted by a band 17 encircling the clamping portion 13. The band may comprise a metal strap having its ends 18 secured together and provided with a female threaded element 19. A rod 20 extends through the overlapped band ends 18 and is threaded through element 19. The inner end of the rod is provided with a cylindrical head 21 received in a slot 22 of a clamping pad 23 for effecting movement of the pad 23 toward and from the axis 15, as best seen in FIGURE 6.

The clamping pad may define an inner segmentally cylindrical surface 24 engaging the clamping portion 13 of the body member in opposition to the engagement of band 17, as shown in FIGURE 6. The threading of rod 20 inwardly through the element 19 urges the clamping pad 23 against at least one, and preferably, as shown several of the clamping portion legs 16 and concurrently pulls the band 17 against the opposite legs 16 to effect a forceful constriction of clamping portion 13 wherein the legs are deflected radially toward the axis 15.

Reversely, a retrograde threading of rod 20 outwardly through element 19 causes a withdrawal of the clamping pad 23 from clamping portion 13 to relax the clamping portion. As shown in FIGURE 6, the outward movement of clamping pad 23 may be limited by the engagement thereof with element 19 to provide a preselected retraction of the clamping means.

The inner end of rod 20 may be provided with a manual operating handle 25, as shown in FIGURE 1, for providing facilitated manual constriction of the clamping means. As further shown in FIGURE 1, the band 17 is effectively retained in association with body member 11 by a pair of axially spaced shoulders defined by a lug 26, and a distal outturned flange 27 on the clamping portion. The clamping pad may be retained between the flange and a second lug 28 on the clamping portion 13 against axial displacement, as further shown in FIGURE 4.

The tube end T to be flared is held in the clamping portion 13 by jaws 29 comprising semiannular jaw elements 30 and 31 movably retained in opposed association by a jaw retainer 32 of resilient synthetic resin material. As shown in FIGURE 5, the jaws are provided with radially opening slots 33 slidably receiving the rectilinear side portions 34 of the jaw retainer 32 for adjustable retention in the juxtaposed relationship.

Thus, a plurality of jaw pairs 29 may be provided for use with different diameter tubes. The paired jaws are removably installed in the cylindrical space 35 defined by

the annular clamping portion 13 and are releasably retained therein by locking shoulders 36 on the clamping portion legs 16 and cooperating shoulder 37 on the cylindrical periphery of the jaws. The shoulders 36 and 37 define segmentally annular shoulders and, thus, the jaw assemblies 29 may be mounted in the clamping portion 13 omnidirectionally, i.e., in any rotational position about the axis 15. As shown in FIGURES 4 and 7, the jaws are preferably beveled so as to facilitate spreading of the clamping portion legs 16 against the resilient biasing thereof in inserting and removing the jaws from the space 35. As discussed above, during such insertion and removal, the band 17 is disposed in the relaxed arrangement to permit the necessary expansion of the clamping portion.

The installation of the jaws in the clamping portion 13 and the removal thereof from the clamping portion 13 is facilitated by use of the jaw retainer 32 as a handle as the jaw retainer projects outwardly from the lower end of the clamping portion 13, as best seen in FIGURES 1, 3 and 4. Further as shown in FIGURE 1, the outturned flange 27 on the clamping portion 13 serves as a limit to the insertion of the jaws by the abutment therewith of the side portions 34 of the jaw retainer 32.

To suitably hold the tube end T during the flaring operation, the tube end is inserted through the cylindrical space 38 defined by the jaw pairs 30 and 31, as shown in FIGURE 4. The inner surface 39 defining the space 38 may be suitably formed to provide improved tube gripping, and as shown in FIGURE 4, is threaded. To effect the desired clamping of the tube end extended through the space 38, the user merely manipulates handle 25 to thread rod 20 through the element 19 thereby constricting the clamping portion 13 as discussed above and, in turn, urging the jaw halves 30 and 31 forcibly toward each other whereby the gripping surfaces 39 firmly hold the tube end coaxially of axis 15.

Flaring of the tube end is effected by urging a flaring cone 40 coaxially into the distal end of the tube, as shown in FIGURE 5. Flaring cone 40 is carried on the lower end of a threaded stem 41 which is threaded to an internally threaded sleeve 42 secured to yoke 12 of the body 11. The upper end of the threaded stem 41 may be provided with a handle 43 to effect rotation of the stem and resultant forcible urging of the flaring cone 40 into the held tube end.

As shown in FIGURE 4, the flaring cone abuts the body yoke 12 in the retracted position of the flaring cone so that insertion of the tube end T through the jaw space 38 into engagement with the cone provides an automatic preselected positioning of the tube suitable to form the desired flare upon subsequent advance of the flaring cone into the tube end, as shown in FIGURE 5. As will be obvious to those skilled in the art, the jaws 29 may be provided with an upper chamfer to define a backup means for the flare where the flare is effected within the jaws rather than in the portion extending upwardly from the jaws, as shown. The clamping of tube end T by the above described constriction of the clamping portion 13 effectively positively holds the tube end coaxially with the flaring cone 40 to provide an improved accurate flare while yet permitting the overall flaring tool to be of minimum size. To further assure accurate alignment of the tube, prevent canting thereof, and provide a balancing of the clamping forces, the internal surface 39 of the jaws is undercut at the lower end 44, as best seen in FIGURES 4 and 5.

WHAT WE CLAIM IS:—

1. A tool for flaring a tube end, comprising: a body member having a yoke portion, and a plurality of spaced resilient clamping portions extending from the yoke portion in an annular array to define a generally cylindrical socket; a pair of part-cylindrical jaws located in the socket and having opposed concave surfaces for engaging a tube to be flared; clamping means for urging the clamping portions radially inwardly thereby to urge the jaws inwardly to clamp a tube disposed therebetween; cooperable shoulder means on the clamping portions and jaws for retaining the jaws against axial movement relative to the clamping portions when urged inwardly against a tube; and flaring means movably carried by the yoke and operable to flare the end of a tube held in the jaws, the resilient clamping portions being so arranged and constructed that the cooperable shoulder means on the jaws and the clamping portions are disengage-able when the clamping means is released to permit insertion and removal of the jaws from the socket.

2. A tool according to claim 1 wherein the clamping portions are uniformly spaced around the socket.

3. A tool according to claim 1 or 2 wherein the flaring means comprises a flaring cone carried on a stem which is threaded to the yoke portion and extends coaxially with the socket.

4. A tool according to claim 3 wherein the flaring cone is retractable relative to the body member to a preselected position in which it is spaced from the jaws located in the socket by a distance equal to the tube length required to provide the desired flared portion of the flared tube end.

5. A tool according to any of claims 1 to 4, wherein the tube engaging surfaces of the jaws are relieved at their ends remote from the yoke portion whereby the tube-receiving aperture defined by said surfaces has an enlarged end portion remote from the yoke.

6. A tool according to any of claims 1 to 5, wherein the jaws are carried by a retainer member having a pair of opposed slide portions slidably supporting the jaws for movement of tube engaging surfaces towards and away from each other, the retainer member maintaining the jaws in juxtaposed relationship to facilitate installation of the jaws in the jaw receiving socket.

7. A tool according to claim 6 wherein the retainer member is resilient and the jaws are removably mounted on the retainer member.

8. A tool according to claim 6 or 7 wherein the retainer member is formed of a resilient synthetic resin.

9. A tool according to any of claims 6 to 8 wherein the retainer member comprises an annular member having a pair of straight parallel sides for guiding the jaws for rectilinear movement towards and away from each other.

10. A tool according to claim 9 wherein the jaws have rectilinear slots in the opposite sides thereof which receive the straight parallel sides of the retainer member.

11. A tool according to any of claims 6 to 10 wherein the retainer member has a portion which projects outwardly from the body when the jaws are located in the socket for facilitating manual removal of the jaws from the socket.

12. A tool according to any of claims 1 to 11 wherein clamping means engages the clamping portions substantially fully about the circumferential extent of the array.

13. A tool according to claim 12 wherein the clamping means comprises a band extending around the array of clamping portions and screw threaded means for drawing the band tightly thereabout.

14. A tool according to claim 13 wherein the body has a pair of spaced shoulders which retain the band against displacement relative to the body in a direction parallel to the axis of the socket.

15. A tool according to claim 14 wherein one of the shoulders is constituted by a lug provided on one of the clamping portions adjacent the yoke portion.

16. A tool according to claim 14 or 15 wherein one of the shoulders is constituted by an out-turned flange on the free end of the clamping portions.

17. A tool according to any of claims 13 to 16 wherein the clamping means includes a pressure-applying part engaging at least one of the resilient clamping portions, and the screw threaded means includes a threaded portion threadedly connected to the band for urging the pressure-applying part against the clamping portions and drawing the band towards the pressure-applying portion to tighten the band around the clamping portions.

18 A tool according to claim 17 wherein the pressure-applying part comprises a pad having an inner surface engaging the clamping portion or portions, and an axial slot in its outer surface, the threaded portion including a male threaded member having a head rotatably received in the slot for moving the pad radially as it is rotated.

19. A tool according to claim 18 wherein the slot has a restricted radial opening through which the threaded portion extends for preventing movement of the head radially outwardly from the slot.

20. A tool according to claim 17 or 18 wherein the body member includes axially spaced shoulders which retain the pad against axial displacement in the slot.

21. A tool according to any of claims 17 to 20 wherein the pressure-applying portion comprises a pad having an inner surface complementary to the outer surface of the clamping portions for facial contact therewith.

22. A tool according to any of claims 17 to 21 including means for limiting movement of the pressure-applying portion away from the body member clamping portions to define a retracted position thereof at which the jaws are removable from the socket.

23. A tool according to any of the preceding claims wherein the jaws have segmentally cylindrical outer surfaces permitting rotation of the jaws in the socket.

24. A tool according to claim 23 wherein the shoulder means comprises cooperating segmentally annular shoulder means on the jaws and clamping portions for releasably locking the jaws against axial movement relative to the clamping portions but permitting rotation of the jaws in the socket.

25. A tool according to any of the preceding claims wherein the clamping portions comprise thin wall elements.

26. A tool according to claim 25 wherein the elements are integrally formed with the yoke portion.

27. A tool for flaring the end of a tube substantially as herein described with reference to the accompanying drawing.

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Fig.1.

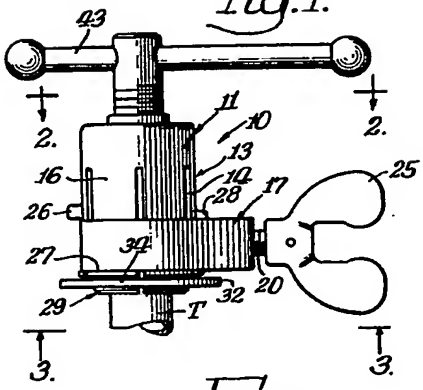


Fig.2.

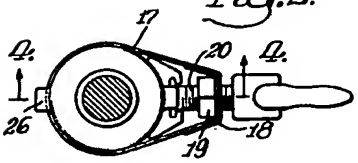


Fig.3.

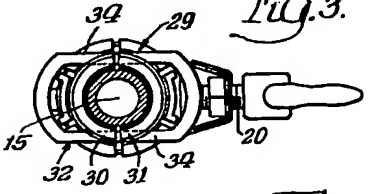


Fig.4.

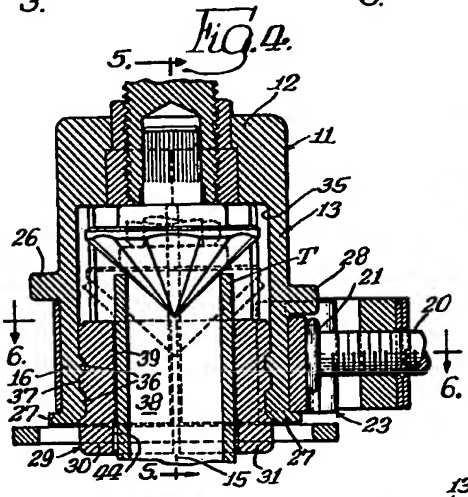


Fig.5.

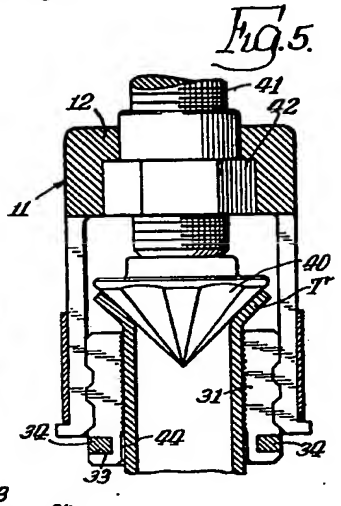


Fig.7.

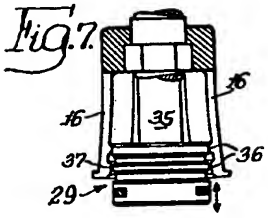
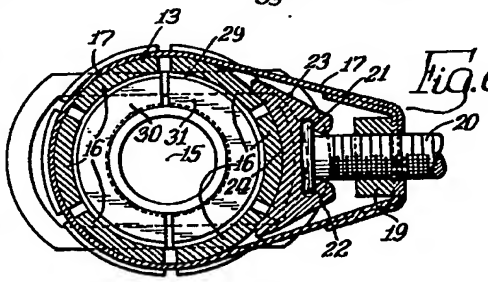


Fig.6.



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